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# **SYSTEM AND METHOD FOR SMS AUTHENTICATION**

## **TECHNICAL FIELD**

The present invention relates to the management of wireless terminal user equipment in general and in particular to a system and method for securing such equipment against malicious use of the so-called Short Message Service.

## **BACKGROUND OF THE INVENTION**

History has shown through phenomenons that have accompanied large scale development of the personal computer, that there is a category of people who find interest in maliciously penetrating other users' computing systems. Their motivation' can include direct material benefit (e.g. use of a user's credentials stored in the computer to perform commercial or financial transactions), or benefit derived from access to confidential information (private information, trade or technology secrets). Sometimes it is just for the -arguable- fun of the performance (e.g. password cracking, virus dissemination, etc.). Whichever the motivation, this behavior is a strong indication that, when a new field of action opens up, the same energy will be spent on malicious attacks.

The wireless communications environment is one of the next likely fields of action. Mobile telephony has grown to hundreds

of millions of users and is keeping a strong status image. In addition, mobile device evolution is clearly directed toward development of increasing computing power: faster processors, substantial storage, functional and applications richness. In fact, the catalogue of most major mobile device vendors includes devices that look very much like personal computers and in an increasing number of instances can replace them. Those devices, as they continue evolving, will play a significant role in business and personal activities.

Mobile communication networks may support various wireless technologies, and particularly the European Standard known as the Global System for Mobile Communications (GSM) or the enhanced General Packet Radio Services (GPRS). Text messages, particularly Short Message Services (SMS) messages may be exchanged between mobile devices through Short Message Service Centers (SMSC). A specific short message type handled by digital wireless networks enables the receiving mobile devices to be remotely managed by a remote device management application system. Such specific SMS results in parameter change commands or software elements to be applied to the device and it will be referred to as 'Configuration SMS' for this discussion. Configuration SMS's may be used in two ways to remotely manage GSM or GPRS-connected mobile devices from the device management application. A first approach is to use the SMS as a content vehicle carrying actual configuration parameters to be applied to the device. A second

approach is to use SMS as a trigger to which the device responds by launching a connection (e.g. Over-The-Air (OTA) connection, SyncML/DM connection) to a management server to perform management-oriented synchronization activities (such as  
5 Inventory, Configuration, Software Download).

In both cases, the use of the SMS technology "as is" is exposing the device to malicious attempts. If the SMS carrying configuration instructions is of malicious origin, commands or software elements carried by the SMS can introduce malicious  
10 entities into the terminal equipment (e.g. undesired parameter changes, personal information retrieving, virus code downloading to name a few). If the SMS is used to trigger a management session to a spoof server, similar malicious actions may be performed over the management session. In fact, a mere knowledge  
15 of the mobile device's telephone number (also known as the MSISDN) and a basic skill in the SMS technology suffice to gain access.

Thus, it has been a main concern to secure the SMS against hacker attacks. Some recommendations for GSM security have been  
20 made available for example in the ETSI GSM 03.48 Technical Specification titled "Security Mechanisms for the SIM application toolkit". While this publication addresses somehow the SMS security problem, the described mechanism only covers security for SMS's carrying executable information to be loaded onto the  
25 Subscriber Identity Module (SIM card). However, using the SIM

card to remotely configure a wireless device with SMS is only one way to operate. Several other possibilities exist where the configuration parameters and the software carried in the SMS's may be applied to the device's operating system without execution in the SIM card. Therefore, there is still a potential target for hacker attacks.

Moreover, a drawback of the SIM-oriented implementation is that the SIM card is associated with the service subscription, i.e. the Wireless Network Operator. As a consequence, the existing security solution is limited to its use by the Operator.

It is therefore essential to apply a commensurate level of security against malicious tampering with the device configuration and software integrity attempted through means that bypass the SIM card.

There is a real need for a more general purpose security solution for wireless terminal user equipment remotely managed through SMS messages, which is independent of the Subscriber Identity Module.

The present invention offers such solution.

#### **SUMMARY OF THE INVENTION**

It is therefore a feature of the invention to provide a system and method to secure the use of wireless terminal user equipment.

It is another feature of the invention to prevent malicious use of SMS's when remotely managing wireless user terminal equipments.

It is another feature of the invention to provide a system and method to secure remote management of a wireless device using Configuration SMS's.

It is yet another feature of the invention to provide a system and method that is applicable to both Wireless Network Operators but also to any other party, typically the Management Services Outsourcers or Enterprises.

The present invention allows SMS messages protection through their encryption computed with the International Mobile Equipment Identity (IMEI) number as a shared key.

In a first embodiment, the invention applies in a text messaging system having the ability to send at least one text message to a wireless terminal equipment wherein the text message contains an information data field and a text data field. The text messaging system preferably comprises means for storing an equipment identification number uniquely assigned to the wireless terminal equipment; means coupled to the equipment identification number storing means for encrypting the text data field content using the equipment identification number assigned to the wireless terminal equipment as the shared key; and means for setting an encryption identifier in the information data field of the at least one text message.

In a GSM network application, the text message is a Short Message Service (SMS) message having a SMS header and TP-User Data that contains configuration commands to remotely manage a SMS mobile device. In this environment, the equipment  
5 identification number is the International Mobile Equipment Identity (IMEI) number assigned to the mobile device.

The more general wireless terminal equipment to be used in the present invention comprises means for storing a personal equipment identification number, and means for receiving an  
10 encrypted text message. It further comprises means for determining if the received encrypted text message contains an encryption identifier that signals the use of the equipment identification number as a shared key encryption. Moreover, the wireless terminal equipment comprises means for decrypting the  
15 encrypted text message by using the personal equipment identification number read from a storage memory of the wireless terminal equipment. The decryption process generates an equipment identification number that is compared to the personal equipment identification number of the device. The message is finally  
20 processed or rejected according to the comparison result.

In another embodiment, a method for authenticating a text message sent by a text messaging system to a wireless terminal equipment having means for storing a personal equipment identification number, the text messaging system comprising means  
25 for storing an equipment identification number uniquely assigned

to the wireless terminal equipment, and wherein the text message having information data field and text data field, includes the steps of:

at the text messaging system:

5        encrypting the text data field content by using the equipment identification number assigned to the wireless terminal equipment as the shared key;

      setting an encryption identifier in the information data field of the at least one text message; and

10       sending the encrypted at least one text message to the wireless terminal equipment;

      at the wireless terminal equipment:

      receiving the encrypted at least one text message;

15       determining if the received encrypted at least one text message contains an equipment identification number as a shared key encryption; and

      decrypting the received encrypted at least one text message using the personal equipment identification number of said wireless terminal equipment as a shared key.

20       Alternatives to the above-described embodiments are set forth in the appended claims.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

The above and other features and advantages of the invention will be better understood by reading the following more



particular description of the invention in conjunction with the accompanying drawings wherein:

Figure 1 shows a general view of the communication environment in which this invention applies.

5 Figure 2 details the User Data part of a SMS frame.

Figure 3 is a flow diagram of the routine processed at the receiving mobile device.

#### **DETAILED DESCRIPTION OF THE INVENTION**

Referring first to figure 1, there is depicted a pictorial  
10 representation of a text message communication system which may  
be utilized to implement the method of this invention. As may be  
seen, message communication systems may include composite  
networks, such as GSM or GPRS networks 10 and Internet network  
12. A wireless terminal equipment 14, which may be for example a  
15 mobile phone, is remotely managed by a device management  
application system 16. This embodiment is hereby described for  
one wireless device remotely managed but as those skilled in the  
art will easily understand it may be generalized to a plurality  
and variety of wireless terminal equipment (such as POS,  
20 hand-held computers, PDA, ...). Each wireless terminal equipment  
14 is identified by a unique equipment identification number  
which is stored in a memory part of the terminal. The device  
management application system 16 comprises an equipment  
identification database to store all the identification numbers

of the wireless terminals that may be recognized by the management system 16. Generally in GSM networks, such database is known as being an Equipment Identity Register (EIR) that contains all valid mobile phone equipment.

5        It is to be mentioned that the mobile device may also contain a SIM card to carry individual information relative to the subscriber. No further details of the SIM card functions are hereby developed as it is not useful for the understanding of the invention.

10        A text message as used in this invention, preferably refers to a Short Message Service (SMS) message sent over the GSM or GPRS network and that allows remote management of wireless terminal equipment. The SMS may contain commands like change instructions for the terminal equipment or may serve as a trigger  
15        to launch a management session with the management server. The path of the SMS message issued from the device management application system 16 may comprise an SMS Center (SMSC) 18 which is responsible for the relaying, storing and forwarding of SMS's.

20        An SMS that is to be received by the mobile device 14 is a data frame structured as it is now described with reference to figure 2. Figure 2 is a representation of a SMS frame as specified in the 3GPP Technical Specification document "*3rd Generation Partnership Project; Technical Specification Group  
Terminals; Technical realization of the Short Message Service  
25        (SMS) (Release 1998)*" (referenced 3GPP TS 03.40 V7.5.0 (2001-12)).

The SMS message contains a SMS frame Header 202 and a SMS frame Body 204. Generally speaking, the frame Header 202 contains the information related to the propagation, delivery, status and purpose of the SMS.

5       The frame Body 204 which is also known in the literature as the TP-UD (Transfer-Layer Protocol User Data) may comprise just the short message content itself 206, i.e. the commands to manage the SMS receiving device, or it may have in addition a User Data Header (UDH) 208. Presence of a User Data Header is identified by  
10   the setting of an indicator in the SMS frame Header, namely the User Data Header Indicator (UDHI). Where the UDHI value is set to zero the TP-UD field comprises only the short message. Where the value is set to one, it means that the TP-UD field comprises a User Data Header. The UDHI parameter is used in the method of the  
15   invention as it will be described later with reference to figure 3.

      The generalized structure of the User Data Header is zoomed on bottom of figure 2, and is mainly made of User Data fields (UDL,UDHL) and a plurality of Information Element groups (IE\_a to  
20   IE\_n). The User Data fields specify the User Data Length (UDL) i.e. the length of the entire message, and the User Data Header Length (UDHL) i.e. the length of the total UDH. Each Information Element group is composed of an Information Element Identifier field (IEI), an Information Element Data Length field (IEDL) and  
25   an Information Element Data field (IED). Some IE groups are

currently reserved for specific purposes, for example for Command Packet designation, and the reader may refer to the aforementioned 3GPP Technical Specification document to learn more about it. However, some IE groups are not allocated and free  
5 of use, and the present invention takes this advantage to allocate an IE group for signaling the use of encryption security. Specifically, the use of encryption using IMEI as a key is signaled through the insertion of a marker (for instance the character string "IMEI") in an Information Element Data field,  
10 and the corresponding IEI and IEDL fields are set to the correct values to indicate the presence and length of the marker.

As already mentioned and as denoted on reference 206 'encrypted IMEI + short message', the encrypted message is a bit string generated from the IMEI number and the Short Message  
15 content. Such computation is conventional and various algorithms such as the so-called Data Encryption Standard (DES) may be used to obtain the encrypted value.

To allow verification of successful decryption, the message sending system preferably prefixes the actual text message with  
20 the IMEI number. If the system operates into conformity with the GSM standard, the IMEI number is fifteen bytes long. However, it is to be appreciated by the person skilled in the art that the invention may be implemented with any other byte lengths of an equipment identification number. Through parsing of the  
25 decrypted string, the wireless device receiving the encrypted

message can verify the matching of the first fifteen bytes with its personally stored IMEI number to establish successful decryption or not.

Figure 3 is a flow diagram of the routine performed at the mobile device receiving an encrypted SMS message. The routine is preferably implemented in a processing area of the mobile device which is outside of the SIM card. Once more, it is to be highlighted the advantage of the present invention over existing alternatives in that the encryption method is not linked to the Subscriber Identification Module.

The process starts with the receipt of an incoming SMS message (step 300).

On first step 302, as part of conventional SMS processing in wireless equipment, a verification is made to check if the message is really containing configuration instructions or software to be installed. If not, the SMS is processed normally as a conventional SMS message (step 314).

If the message is of the type enhanced with configuration commands, the process enters the encryption checking. The SMS frame Header is looked up (step 304) to locate a User Data Header Indicator (UDHI). If no UDHI is encountered (branch No) the SMS is rejected (step 316).

If a User Data Header Indicator is found, next step 306 allows to check if an Information Element (IE) group in the User Data Header is dedicated to the signaling of the IMEI-based

encryption. More specifically, it is checked for the presence of an Information Element Identifier (IEI), an Information Element Data Length (IEDL) and an Information Element Data (IED) allocated to the IMEI encryption security.

5           If no IMEI dedicated IE group is found (branch No), the SMS is rejected (step 316) because again the SMS does not conform to the security requirement of having encryption.

          If an IMEI dedicated IE group is found (branch Yes), decryption of the message is attempted on step 308. The  
10       decryption operation uses the IMEI key already stored in a memory space of the mobile device. It is to be appreciated that the decryption algorithm itself is not detailed as any such known procedures may be applied as far as the IMEI key is used.

          The decryption result is next parsed (step 310) to extract  
15       the first fifteen bytes, which are then compared to the IMEI personal number stored in the mobile device memory (step 312).

          A mismatch leads to the SMS being rejected (step 316) while a match allows the SMS to be processed (step 314).

          To summarize, the present invention offers a security  
20       mechanism for the Configuration SMS messages through an encryption based on a confidential key. The key is the IMEI (International Mobile Equipment Identity) number which offers several advantages:

- each GSM or GPRS mobile equipment has its own and unique  
25       IMEI;

- the IMEI plays no role in the communications between Users and is therefore not published,
- the IMEI already exists, which avoids having to introduce a new scheme to create and distribute the keys.

5           In addition, the IMEI is tied only to the device and is independent from the service subscription as materialized by the SIM card. Therefore, the present invention applies to device management performed by the Wireless Network Service Provider but also any other party, for instance Management Services  
10   Outsourcers or Enterprises.

          The activation of the encryption security requires both parties to agree on its use. The managing party needs to encrypt the message and activate the "Encryption Using IMEI" field in the User Data Header of the SMS while the user needs to be using a  
15   device that is enabled to decrypt a message using the IMEI as the key.

          It is to be appreciated by those skilled in the art that while the invention has been particularly shown and described with reference to a preferred embodiment thereof, various changes  
20   in form and details may be made without departing from the spirit and scope of the invention.